

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVIII.

BOMBAY.

No. 4

A POPULAR TREATISE ON THE COMMON INDIAN
SNAKES.

ILLUSTRATED BY COLOURED PLATES AND DIAGRAMS,

BY

MAJOR F. WALL, I.M.S., C.M.Z.S.

Part VIII with Plate VIII and Diagram 1.

(Continued from page 554 of this Volume.)

The genus *Bungarus* as considered by Professor Boulenger in his Catalogue* includes but six species. Since the publication of this work he has added another to the list entitled *sindanus*, and I have added one to which I attached my own name.

I have for a long time tacitly dissented from Mr. Boulenger's views with regard to the forms he describes under the name *candidus*, believing that under that title at least three well marked species are included. To two of these he has conceded the minor rank of "variety" under the names *caeruleus* and *multicinctus*. Another very distinct form is that to which Evans and I applied the name *magnimaculatus*† and recorded as a variety of *caeruleus*.

Now all of these forms are very distinctive in colour and markings, are not connected by intermediate forms, inhabit very definite geographical areas, and show differences in lepidosis, so that I feel there is every justification for each being recognised as a distinct species.

My recent collections in Assam and Darjeeling have further revealed to me the occurrence of two distinct kinds of black krait which hitherto have been included under the title *lividus*.

* Snakes in the British Museum, 1893 to 1896.

† Journal, Bombay Natural History Society, Vol. XIII., p. 611.

The total number of recognisable species now amounting to twelve, I think a brief review of the different forms is called for before discussing the common Indian form *cæruleus* with which this paper deals.

The easiest way to approach the subject is I feel by appending a table indicating at a glance the main points made use of in differentiation.

The key which follows is added to still further simplify the process of identification.

Some brief remarks on each of the species follow.

Name of species.	2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	Vertebrae in midbody broader than long.	Ventrals.	Subcaudals.	Some subcaudals at end of tail divided.	2nd supralabial decidedly narrower than 3rd.	Body compressed.	Number of bands on body.	Number of bands on tail.	Habitat.
<i>flaviceps</i> ..	13	13	13	Yes	193-226	42-55	Yes	?	?	None.		Malay Archipelago and Peninsula, Cochin China and Tenasserim.
<i>bungaroides</i> ..	15	15	15	„	220-238	44-51	„	Yes	No	Many equidistant white lines. Belly white.		W. Hima l a y a s, K h a s i Hills, N. Cæhar.
<i>avidus</i> ..	15	15	15	No	209-215	35-42	No	„	„	None.		The Brahmaputra Basin South of the Himalayas.
<i>cæruleus</i> ..	15	15	15	Yes	200-218	38-50	„	No	„	Many white lines in pairs.		Indus and Ganges Basins. Peninsular India and Ceylon.
<i>ceylonicus</i> ..	15	15	15	„	219-235	33-40	„	Yes	„	15 to 20 2 to 5 bands surrounding belly.		Ceylon.
<i>fasciatus</i> ..	15	15	15	„	200-234	23-39	„	„	„	16 to 27 2 to 3 complete yellow and black bands.		Brahmaputra Basin South of the Himalayas, Mahanadi Basin, Irrawaddy-Salween Basins.
<i>magnimaculatus</i> .	15	15	15	„	218-229	42-49	„	„	„	11 to 14 2 to 3 Bands not surrounding belly.		Irrawaddy Basin.
<i>multinotatus</i> ..	15	15	15	„	194-218	45-53	„	„	„	31 to 45 11 to 13 Bands not surrounding belly.		From S. China to the Irrawaddy-Salween Basins and Andamans.
<i>niger</i> ..	15	15	15	„	216-231	47-57	„	„	„	None.		Brahmaputra Basin South of the Himalayas.
<i>candidus</i> ..	15	15	15	„	210-222	40-50	„	?	„	20 to 25 7 to 9 Bands not surrounding belly.		Malay Peninsula and Archipelago.
<i>indanus</i> ..	19	19	17	No	218-237	48-52	Yes	No	„	Many white lines in pairs.		Sind.
<i>walli</i> ..	17 or 19	17 or 19	17	Yes	192-207	48-55	No.	Yes	Yes	Many equidistant white beaded lines.		Ganges Basin.

KEY TO THE KRAITS (Bungarus).

- SCALES IN 13 ROWS IN MIDBODY..... *flaviceps*.
- SCALES IN 15 ROWS IN MIDBODY.
- A. Shields at tip of tail divided..... *bungaroides*.
- B. Shields at tip of tail entire.
- (a) Vertebrae narrow, longer than broad, not as broad as last row in midbody..... *lividus*.
- (b) Vertebrae as broad or broader than long in midbody.
- (a¹) 2nd supralabial as broad as 1st and 3rd *caeruleus*.
- (b¹) 2nd supralabial decidedly narrower than 3rd and often than 1st also.
- (a²) Belly banded with black. Subcaudals 23 to 40.
- (a³) Tail tapering to a point. Banded with black and white. Peculiar to Ceylon..... *ceylonicus*.
- (b²) Tail blunt and fingerlike at end. Banded with yellow and black *fasciatus*.
- (b²) Belly not banded. Subcaudals 40 to 57.
- (a²) 11 to 14 streaked white bands on body, 2 to 3 on tail *magnimaculatus*.
- (b²) 20 to 25 pure white bands on body, 7 to 9 on tail *candidus*.
- (c²) 31 to 45 pure white bands on body, 11 to 13 on tail *multicinctus*.
- (d²) No bands. Back quite black *niger*.

SCALES IN 17 OR 19 ROWS IN MIDBODY.

- A. Vertebrae longer than broad in midbody. Ventrals 218 to 237. Peculiar to Sind..... *sindanus*.
- B. Vertebrae broader than long in midbody. Ventrals 192 to 207. Peculiar to the Basin of the Ganges *walli*.

Flaviceps (Reinhardt).—This is the only one of the group with 13 scale rows. It is really a Malayan snake extending into our Territory only in Tenasserim, which is a part of the Malayan Sub-region.

Bungaroides (Cantor).—This shares with *flaviceps* and *sindanus*, the peculiarity of having some of the terminal subcaudals divided. It differs from both in having 15 scale rows. It is a rare snake known only from the Eastern Himalayas in the vicinity of Darjeeling, the Khasi Hills in Assam and North Cachar.*

* Annandale, Journ. As. Soc., Bengal, Vol. LXXIII., p. 210.

Lividus (Cantor).—This is peculiar in having the vertebrals but slightly enlarged. They are narrower than the last costal row, and longer than broad in the middle of the body. This peculiarity it shares with *sindanus* alone, but differs from that species in the scale rows being 15. It is quite black dorsally, not banded ventrally, and in these particulars like *niger* differing in the narrow vertebrals and in having fewer ventrals and subcaudals. There are four specimens in the British Museum which I have examined. Three are from Assam and one from India, precise locality not on record. I have lately received one from the Jalpaiguri District, two from Tindharia and one from near Tezpur, Assam, and examined another in the Museum of St. Joseph's College, Darjeeling, precise locality not known. The specimen from Saidpur recorded by Sclater* is probably of this species. All the localities from which it has been recorded are within the Basin of the Brahmaputra River.

Cæruleus (Schneider).—This is dealt with in the paper which follows.

Ceylonicus (Gunther).—This snake has alternate black and white bands which encircle the body and is peculiar to Ceylon.

Fasciatus (Schneider).—A very well marked form with black and yellow bands which completely encircle the body. The tail is peculiar in being blunt and fingerlike, and the back is ridged in a manner not seen in any other krait. It extends from South China and the Malay Sub-region through Tenasserim, to the Irrawaddy-Salween Basins, thence to the Brahmaputra Basin and the Eastern part of the Ganges Basin. (I have lately seen a skin from Bettiah, N.-W. Behar.) It is also common in a restricted area of the north-eastern part of Peninsula India, corresponding roughly to the Mahanadi Basin.†

* J. A. S., Bengal, LX., p. 246.

† A single specimen in the British Museum labelled Anamallays and presented by Colonel Beddome is the solitary record of this snake from Peninsula India outside the area above specified. This record I discredit for the following reasons. A study of Boulenger's Catalogue and Sclater's list of snakes in the Indian Museum (Journal Asiatic Society of Bengal, Vol. LX) reveal the fact that no less than seven other species are recorded by Colonel Beddome alone from various parts of Southern India, all well-known inhabitants of other parts. These are *Tropidonotus himalayanus*, *T. subminiatus*, *T. parallelus*, *Lycodon jara*, *Simotes splendidus*, *S. ocolineatus*, and *Dendrelaphis candolineatus*. That Colonel Beddome received snakes from the Himalayas, Burma and Tenasserim, the localities from which these species are otherwise known, is certain, for there are specimens in the British Museum presented in his name from these areas, viz., *Simotes albocinctus*, *S. violaceus*, *S. cyciurus*, *S. crurintatus*, and *Dipsadomorphus hexagonotus*. It seems certain that all of the species above alluded to including a *B. fasciatus* were received from the localities just enumerated, and by an oversight mixed up with Colonel Beddome's S. Indian collections.

Magnimaculatus (Wall and Evans)*.—This form was first specially remarked upon by Evans and me who proposed the above name for it as a variety of *caeruleus*. Sclater had in 1891 made allusion to two specimens in the Indian Museum which I have now examined. I saw no specimen in the British Museum when I examined the kraits there some five years ago. There are 11 to 14 broad streaked bands on the body and 2 to 3 on the tail. These are white with black streaks in the length of the snake. The black intervals are rounded off near the ventrals, so do not embrace the belly. I have seen 5 specimens.

It is only known from a limited area in the Irrawaddy Basin, Meiktila and Monywa (Wall and Evans), Meiktila (Sclater), and Colonel G. H. Evans has written to me that he has met with it in Hmawbi, Myingyan, and the Shwebo District.

Multicinctus (Blyth).—This considered by Boulenger but a variety of *candidus* differs by its very distinct colouration, and its habitat. It has from 31 to 45 pure white bands over the back on the body, and 11 to 13 on the tail. The black intervals do not surround the belly. It appears to be uncommon in the whole of the area it inhabits which ranges from Southern China to the Irrawaddy-Salween Basin†. Within our limits it is known from Insein and Rangoon (Wall and Evans), Toungoo (Boulenger), and an example in the Indian Museum is from the Andamans. Fig. 4 of our Plate is from an excellent example. I have examined 10 specimens.

Candidus (Linne).—This is the form originally described by Linné from Java. It is black with from 20 to 25 broad light bands on the body, and 7 to 9 on the tail. These bands may be pure white as shown in figure 7 of our Plate, or may be more or less subdivided by a mottling of black. It is only known from the Malay Peninsula and Archipelago.

Niger (Wall).—This has been confused until now with *lividus*, from which it differs in having the vertebral row of scales broad (broader than long in midbody) and a greater number of ventrals and subcaudals. It appears also to grow to a larger size, my largest specimen being 4 feet and half an inch, whereas I do not know of

* Bombay Natural History Journal, Vol. XIII., p. 611.

† I think the locality of one given as Purneah in the Indian Museum, viz., No. 13733 (or 9?), calls for confirmation.

a specimen of *lividus* exceeding 3 feet 2 inches. I have had within the last year 7 specimens from Dibrugarh and Sadiya (Assam), and more recently eight from Tindharia and Pashok, 1,000 to 4,500 ft. (Eastern Himalayas). Slater (Journal, Asiatic Soc. of Bengal, Vol. LX., p. 246) under the title *lividus* mentions three specimens in the Indian Museum from Sibsagar and the Garo Hills (Assam), and Saidpur in the Dinajpore District. The latter I could not find, but the two Assam specimens are *niger*. I have seen 16 examples.

Sindanus (Boulenger).—Until 1897 the only specimen known had been regarded by Professor Boulenger as an aberrant *cæruleus*. It differs however in having the costals in 17 or 19 rows in midbody, the vertebral row of scales longer than broad in midbody, and in having a larger number of ventrals. It is also peculiar to Sind. The specimen recorded by Annandale as such from Midnapore* is the next species.

Walli (Wall).—This very distinct form agrees with the last in the possession of from 17 to 19 scale rows in midbody but differs in having far fewer ventrals, the vertebral row of scales broader than long, the subcaudals entire throughout, the 2nd supralabial markedly narrower than the 3rd, and usually than the 1st also, a markedly compressed body, and in colouration and habitat. There are many white, equidistant arches across the back, composed of ovate white spots which have no tendency to be arranged in pairs. The tail is more or less mottled beneath especially towards the tip. It is only known from the Ganges Valley. I obtained 8 specimens in Fyzabad and have seen two more in the St. Joseph's College Museum, Darjeeling, which formed part of the collection of the late Dr. Vincent Richards; the locality not known but probably Bengal, also four others in the Indian Museum from Purneah and Midnapore.

THE COMMON KRAIT (*Bungarus cæruleus*).†

Nomenclature.—(a) *Scientific*.—*Bungarus* was applied originally by Daudin in 1803 and is derived from “bungarum pamah,” a vernacular name applied according to Russell‡ to the banded Krait (*Bungarus fasciatus*) in Bengal.

* J. A. S., Bengal, 1905, p. 213.

† My conception of this as a species is based upon an examination of well over 200 specimens.

‡ Ind. Serp., 1796, Vol. 1, p. 3.

The specific name *cæruleus* (Latin, meaning blue) was given by Schneider* in 1801 to this form. (Figure 5 of our plate.)

(b) *English*.—The Krait, or common krait, is borrowed from the vernacular name for this snake in certain parts of Northern India.

(c) *Vernacular*.—The plethora of native names shows that the snake is abundant, and well known everywhere. Some names appear very local. It is probable there has been confusion between this and other snakes as one must expect with natives especially.

Nicholson† says it is called “Anali” about Madras, a word, he says, implies “ringed” or “decorated” in Tamil and kindred languages, and is somewhat loosely applied.

I have known it called “kattu viriyan” about Trichinopoly, the Tamil for “banded viper.” Father Bertrand also writes me it is known under this name in S. India, as also is *Lycodon aulicus*; “viriyan” too, he remarks, though meaning “viper,” is applied to many non-poisonous snakes.

Jerdon‡ says it is the “yenna vyrien” of the Tamils: “yenna” is the Tamil for “oil,” and must refer to the oily polished surfaces of the scales. I have also known it called “kutti pisarshi” “bad devil,” and “panna viriyan” or “palmyra viper” in South India.

In Mysore Rice§ gives the Canarese name for it as “godî nagara” which appears to me very doubtful from the English interpretation “wheat cobra.”

In Cannanore it was called “valla pambou” which is Malayalam signifying “bangle snake.”

Colonel Dawson tells me that in Travancore it is known as “yettadi veeren” (Malayalam) and “yettadi virien” (Tamil), “yettadi” means “eight feet” and implies that the snake is so venomous its victim dies within eight paces; “veeran” and “virien” he suggests may be derived from the Tamil “visham” “poison.”

Russell¶ says the Tamils call it “karu walalay”: “karu” is the Tamil for “black,” and “walalay” I am told means “polished.”¶ Again he says the snake he figures on Plate XXI in his second

* Hist. Amph. II, p. 284.

† Ind. Snakes, pp. 133 and 134.

‡ Journ., Asia. Soc., Bengal, Vol. XXII., p. 522.

§ Mysore, Vol. I, p. 188.

¶ Loc. cit., Vol. II., p. 36.

¶ I am indebted to Dr. J. R. Henderson of Madras for many of the translations of vernacular names in use in S. India.

Volume (clearly a krait though peculiar in colouration) is called "Seu walaley." "Seu" or "Sew" means "brown." The same authority* says this snake is called "gedi paragoodoo" further north about Vizagapatam. Mr. J. M. Turing, Deputy Commissioner at Vizagapatam, to whom I lately appealed for information, says the words are Telugu, "gaddi" meaning "grass," and "parugudu" a "runner." He suggests that this is the same snake known about there as "tutte purugu," the Telugu for "rubbish reptile." Russell's other name for this species in this locality, *viz.*, "pakta poola" he can throw no light on.

I have frequently heard it called "krait" or "karait" by natives but am not sure whence these names emanate. Sampwallahs journey far from their own homes, and coolies and some of one's household servants too, and many will consequently make use of these names in a locality where they may not be known. Kallan, the snake catcher, I knew in Delhi always called this species "krait," but Major McMahon† says "krait is I presume merely an English corruption of the Urdu word *kalgundait*. If not it must be a Bengali corruption of it, as no native of Delhi would understand you if you spoke of the *karait* or *krait*." I have had "*kálgundait*" given me by a native of Karnal in the Punjab for the *Zamenis diadema*, but there seems little doubt it is the Urdu name for the krait. I find Baboo Awmoola Ruttum Bysach in his work on medicine written in Urdu gives the name for this krait which he mentions by its scientific name *cæruleus* and describes, as "*kala gandait*." He says the "*kala*" means black, and that "*gandait*" refers to the white lines across it. I cannot however find confirmatory evidence of such a word in Urdu. He also gives as one of its names "*dhaman chitti*," "*chitti*" I find means speckled or variegated. These names "*chitti*" and "*dhomum*" or "*dhomna chitti*" are also mentioned by Fayrer‡ and Ewart§ as being used in Bengal. It must be noted that "*chittee*" is the name applied according to Russell to a very different snake in Bengal, *viz.*, *Helicops schistosus*.¶ A European subordinate who had been many years in

* Loc. cit., Vol. I., p. 2.

† Fayrer's Thanatoph. Ind., p. 11.

‡ Loc. cit., p. 122.

§ Ind. and Australn. Snake Poisoning, 1874, p. LXXVII.

¶ Loc. cit. II., plate IV.

the Kheri District (U. P.) and knowledgeable in discriminating snakes told me that it is known locally there as "goohooan."

Colour and marks.—In this form there are closely set white linear arches thrown across the back, arranged more or less distinctly in pairs. These are much more perfect and conspicuous in the posterior part of the body, and tail. At midbody or further forward they gradually fade especially laterally, and may become replaced more anteriorly by white vertebral spots, or may even completely disappear. The black on the back is lustrous, and if the light be allowed to glance on it appears even bluish, hence the name *cæruleus*. The top of the head is black, fading to white on the lips. The belly is white like mother of pearl in its entire length including the tail to its extreme tip. The young of *cæruleus* show more white. Not only are the arches posteriorly more conspicuous than in adults but they are often unusually apparent in the anterior half of the snake, and there is often a partial or complete white collar, and some white on the top of the head. Two white bands too pass upwards from the 2nd and 5th supralabials, the former in front of, and the latter behind the eye.

In adults specimens occur in which the black is tinged more or less deeply with brown, and I have seen one specimen from Fyzabad in which the black had a metallic lustre, resembling that of black lead on a grate compared with the purer black on a polished boot.

Russell* figures a curious specimen from Tranquebar, in which the body is dark-brown, the anterior six or eight inches uniform buff, and the linear arches bluish. It suggests to me the possibility of having been preserved in some chemical, or that the specimen was an old spirit one. I have in many small collections and museums seen specimens in which the spirit had been allowed to evaporate, and the specimens kept in a strong light. In such a case the black of the krait fades to brown, and where left dry as often happens when the head is suspended to the cork or stopper the colour fades to a tint very like that shown in this illustration. Quite light specimens are occasionally heard of which may be regarded as albinos. One such is in our Society's collection, and Mr. Phipson drew my attention to it in 1904 when I was in Bombay.

It must be emphasized, however, that though the ground colour is

* Loc. cit., Vol. II, plate XXXI.

occasionally modified, the number, disposition, and character of the white arches remain distinctive.

About the form depicted in figure 6 of our Plate I am very uncertain. The double white bands suggest that it may be merely a variety of the last form though I cannot think so. I am very familiar with typical *cæruleus* from many parts of India, and have always found it the same, with no suggestion of forms intermediate between those shown in figures 5 and 6 of our Plate.

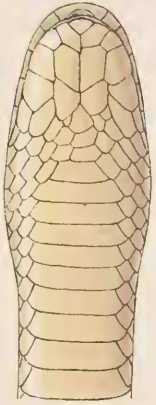
I speak with doubt but my impression is that No. 6 is a form peculiar to Bengal. I am not aware that I have seen it except in the Zoological Gardens in Calcutta where it is usually, if my recollection serves me, represented by several specimens. This recollection makes me incline to the belief that it may be a local form. I trust some of our members may assist in clearing up any doubts as to its distribution and relationship with the last.

Distribution.—I have seen examples from Ceylon*, Trichinopoly, Cannanore, Bangalore, Madras, Berhampore (Ganjam), Bilaspur, and Saugor (C.P.), Sitapur, Fyzabad, Gonda, Agra, Delhi, Godda (Behar), Umballa, Bannu and Sind.† All of these specimens are alike in possessing paired linear arches. Figure 5 of our Plate shows these arches rather too stiff and conventional, but the figure otherwise is good.

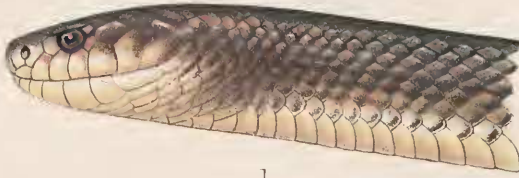
* Spol. Zeylan., Vol. IV, Part XVI, p. 174.

† The only observer who has recorded this form East of Calcutta is Cantor, who referred to it from the Malay Peninsula, and sent five specimens from this locality to the British Museum. I think I can show good grounds for doubting the accuracy of these records. It is to be noted that the same authority stands alone in recording at least six other well known Indian species from the Malay Peninsula, all otherwise not recorded outside Indian limits. These species are *Typhlops bethriorhynchus*, *Polyodontophis sagittarius*, *Xenochrophis cerasogaster*, *Helicops schistosus*, *Zamenis fasciolatus*, and *Hypsirhina sieboldii*. (Vide Cat. Snakes Brit. Mus., 1893 to 1896, Vol. I, pp. 23, 188, 191, 274, 405, and Vol. III, p. 12). It will be noticed that all of these species are to be met with in Western Bengal, where indeed many are common. Now it is certain that Cantor received snakes from Bengal among other parts of India, for there are specimens in the British Museum presented by him and labelled from Bengal. These include *Polyodontophis sagittarius*, *Xenochrophis cerasogaster*, *Lycodon jara*, and *Hypsirhina enhydria*. (Vide Cat. Vol. III, p. 598, Vol. I, p. 191, Vol. III, pp. 618 and 7.)

From these facts it is difficult to escape the conviction that all the five specimens of *cæruleus* sent by Cantor to the British Museum (labelled, Penang) were received with the other snakes just enumerated from Bengal, and inadvertently mixed with his own local collections.



2



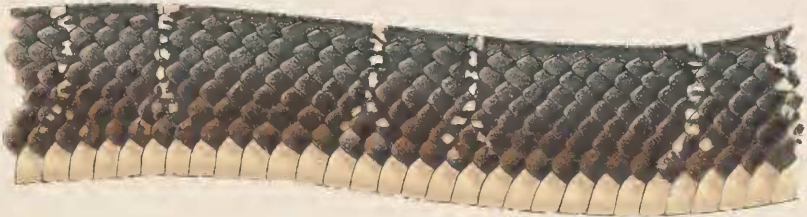
1.



3



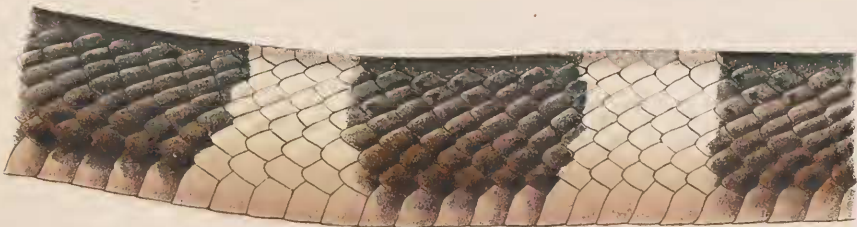
4



5



6



7.

J. G. del.

J. Green Chromo lith.

THE COMMON "KRAIT".
Bungarus candidus, (poisonous).

Dimensions.—The krait grows to $4\frac{1}{2}$ feet. I have measured the skin of one from Bannu 4 feet $6\frac{1}{2}$ inches, and seen half a dozen others over 4 feet, but specimens of this size are rare. Murray* gives the length as 5 feet, but of this I have doubts. I think he probably referred to the Sind krait (*B. sindanus*), a larger form which was confused with *caeruleus* for some years, and only recognised as a distinct species by Boulenger in 1897.†

It would appear that this snake is common with many other attains a greater length in the North than in the South. The only specimens over four feet in length I have seen were in Orissa, in Fyzabad, and on the North-West Frontier. Colonel Dawson, who reports the krait a very common snake about Trivandrum, says the largest record there he is aware of was 3 feet 4 inches. The largest specimen known to Dr. J. R. Henderson in Madras was 3 feet 8 inches. Again a hatchling I obtained in Cannanore was $10\frac{1}{2}$ inches, whilst specimens from Fyzabad varied from $11\frac{1}{2}$ to $11\frac{3}{4}$ inches.

Physiognomy, bodily configuration, etc.—One noticeable feature, which some of our vernacular names show has not escaped observation, is the highly polished and glistening character of the scales. The black in which some see a bluish tinge is thus lustrous like a highly polished boot, and the white almost enamel-like. The head is less flattened than in many snakes, the snout rounded, and the neck but little evident.

The eye is peculiar in that the iris is not coloured, and as a result the shape of the pupil, which is round, cannot be discerned in life. The organ as a whole looks like a jet bead, and in this respect the snakes of this genus are nearly unique among the Colubridæ. The Lycodons alone, as far as I am aware, share this peculiarity. Figure 1 of our Plate does not clearly illustrate this. The nostril is rather large, occupying the full depth of the suture between the nasal shields. The tongue is pinkish and in having white tips presents a peculiarity I can only recall having seen in *Dipsadomorplus trigonatus*. The body is round, and of very even girth in its whole length. The tail tapers evenly and rapidly, and is short, being about one-eighth to one-ninth the total length of the snake.

* Rept. of Sind, p. 55.

† Bomb. N. H. Journ., Vol. XI, p. 73.

Breeding.—The krait is known to be oviparous. The exact mating season I have not been able to ascertain with certainty, but it is probably during the months of February and March.

Period of gestation.—This is not known.

Incubation.—The female, after discharging her eggs, remains coiled up with them, at any rate until they are well advanced towards incubation. In the case reported in this Journal by Bannerman* the eggs which were found with the mother contained embryos “about six inches long.” In another instance eggs unearthed with the mother in Bannu and sent to me were found to contain young embryos.

Eggs.—Specimens from two clutches that I have examined struck me as being unusually large for the size of the snake. The measurements in each case were the same, *viz.*, $1\frac{3}{8}$ inches in length and $\frac{3}{4}$ inch in breadth. When freshly discovered they were reported “like pigeon’s eggs and plump.” They were white, the poles equally rounded, the shape elongate, and the shell soft, yielding, and of a leathery texture.

This species is not very prolific as snakes go. In the gravid female reported by Blanford † from Bilaspur there were 9 eggs. With the specimen reported by Bannerman only 6 eggs were found. In one clutch sent me from Bannu last year there were 10.

Season of deposition.—The eggs are deposited probably in April and May in holes in the ground a foot or two from the surface. Two clutches were found in June last year at Bannu when removing the old stopbutt. In Bannerman’s example they were unearthed at Parel on the 24th May.

Period of incubation.—This is not known.

Embryos.—The embryos hatch out in May, June and July and measure about $10\frac{1}{2}$ to $11\frac{3}{4}$ inches as they emerge from the egg. One in Cannanore measured $10\frac{1}{2}$ inches in June, and four in Fyzabad varied from $11\frac{1}{2}$ to $11\frac{3}{4}$ inches in June and July. From this it would appear that specimens in the South run smaller than those in the North of India. They grow nearly a foot in the first year of life, and a foot or more in the second and third years as may be judged from the annexed table.

* Vol. XVI, p. 743.

† Journl. Asiat. Soc., Bengal, Vol. XXXIX, p. 374.

The sexes.—The sexes are of similar length when hatched, and remain so apparently till the fourth year. In the fifth year, if one is justified in judging from such meagre figures as appear in the attached table, the males appear to outstrip the females, as the four specimens over four feet in length in which I have recorded the sex were all males.

The longest females I have records of were 3 feet 6 inches, 3 feet 6½ inches, and 3 feet 7¾ inches, all from Fyzabad.

Males appear to be more numerous than females, for of 67 specimens in my notebook where sex is recorded 40 were males.

Maturity.—Judging from the table appended, the gravid female reported by Blanford in Bilaspur as 2 feet 11 inches long in June, must have been beginning her third year of life.

Anal glands.—The anal or scent glands secrete a blackish material of the consistency of a soft ointment. This has a peculiar, rather disagreeable, but not very penetrating, odour. The glands in both sexes are active at all seasons, and at all ages from the time of hatching, so that I am inclined to question the popular belief fostered by Darwin * among others that they are concerned with the sexual functions.

The following table gives the growth of the krait as shown by my records extending over several years. The specimens have been collected in various parts of Peninsular India, North and South. July and August are selected as the months furnishing the largest material.

July.				August.			
Number.	Sex.	Range of lengths.	Average length.	Number.	Sex.	Range of lengths.	Average length.
3	♂	1' 1" to 1' 2½" ...	1' 1¾"				
5	♂	11¾" to 1' 1¾" ...	1' 0¾"				
3	♂	1' 8¾" to 1' 11½" ...	1' 10¾"	3	♀	1' 5¼" to 1' 11¾" ...	1' 8"
4	♂	1' 11½" to 2' 3¾" ...	2' 0¾"				

* Descent of Man, p. 539.

July.				August.			
Number.	Sex.	Range of length.	Average length.	Number.	Sex.	Range of length.	Average length.
3	♂	3' 0 $\frac{1}{2}$ " to 3' 3 $\frac{1}{4}$ " ...	3' 2"	3	♂	2' 6" to 2' 8 $\frac{1}{4}$ " ...	2' 7 $\frac{1}{2}$ "
3	♀	2' 11 $\frac{1}{8}$ " to 3' 1 $\frac{3}{4}$ " ...	3' 0 $\frac{3}{8}$ "	3	♀	2' 6" to 2' 10 $\frac{3}{4}$ " ...	2' 8 $\frac{3}{8}$ "
2	♂	3' 7 $\frac{1}{4}$ " to 3' 9 $\frac{1}{2}$ " ...	3' 8 $\frac{3}{8}$ "	4	♂	3' 5" to 3' 7" ...	3' 6 $\frac{1}{2}$ "
2	♀	3' 6" to 3' 6 $\frac{1}{2}$ " ...	3' 6 $\frac{1}{4}$ "	1	♀	3' 7 $\frac{3}{4}$ " ...	3' 7 $\frac{3}{4}$ "
2	♂	4' 0 $\frac{1}{8}$ " to 4' 1 $\frac{1}{4}$ " ...	4' 0 $\frac{6}{8}$ "	2	♂	4' 0' to 4' 4 $\frac{3}{4}$ " ...	4' 2 $\frac{3}{8}$ "

Identification.—It is a matter of surprise to me and worthy of special remark how very few of the European population in this country are able to identify the krait in spite of its wide distribution, numerical strength, its extremely deadly nature, and the fact that it possesses exceptionally distinctive and easily recognisable characters. With the exception of a very few medical officers, and a still smaller number of naturalists, I have scarcely met a soul who has any idea what the krait looks like, with the result that I get almost every variety of common harmless snakes sent in to me as such. It is difficult to account for such lack of interest in a country where poisonous snakes abound. The popular idea is that the krait is a small snake which haunts our habitations, and any small snake has merely to enter a house to be set down forthwith as a krait. The first essential in diagnosis is the enlargement of the vertebral row of scales. This peculiarity is found in only a few other snakes besides the genus *Bungarus* notably the genera *Dipsadomorphus*, *Dendrophis*, and *Dendrelaphis*, some species of *Amblycephalus*, *Xenelaphis hexagonotus* and *Elachistodon westermanni*. The second point to look for concerns the shields under the base of the tail (subcaudals). These shields in most snakes are divided by oblique sutures into pairs, but in most kraits they resemble the shields beneath the belly in that they pass right across the tail. These two points taken together are sufficient to declare the snake a krait. 11 of the 12 known species can be

thus distinguished.* So it only remains to separate the species under discussion from its closely allied forms. Attention must be paid to the following points:—(1) The costals are arranged in 15 rows. This excludes *flaviceps*, *sindanus* and *walli*. *Ceruleus* is the only one of the remaining species in which the 2nd supralabial is as broad as the 3rd. The number and character of the white arches is distinctive, and its distribution will assist where any doubt may arise.

It is to be noted that it is the only krait inhabiting the Indian Peninsula South of the Ganges if we exclude *fasciatus* which occurs in the basin of the Mahanadi only. In Sind it is associated with *sindanus* and north of the Ganges with *walli*.

It does not occur in the Brahmaputra Basin where it is replaced by *bungaroides*, *lividus* and *niger*.

In Ceylon it is associated with *ceylonicus*.

It does not occur in Burmah but is replaced by *magnimaculatus* and *multicinctus*.

There should be no difficulty in recognising any snake as a krait, however mangled the specimen may be.

Several snakes bear some superficial resemblance to the krait, and these we are figuring in our next two Plates. I reserve comment upon the resemblances, and the further characters to be relied upon in distinguishing between them, till discussing each form separately, but it is to be noted that none of them share either of the peculiarities affecting the vertebral row of scales, and the subcaudals given above as characteristic of the kraits.

Disposition.—The krait is one of the most inoffensive snakes I know. I have had numerous living examples brought to me, and have kept several in captivity, so that my opportunities for studying its nature have been abundant.

Time after time I have recorded the singular timidity of this snake in my notebooks, often under the greatest provocation, and only once have I seen one bite at anything in anger. This specimen had been impaled through and through by a trident and could only

* In one rare species inhabiting the Eastern Himalayas and Assam Hills, *viz.*, *bungaroides*, some specimens have all the subcaudal shields divided, so that the diagnosis here given for *ceruleus* though holding good for nearly all the kraits, breaks down as an absolute generic test. I have therefore in a previous paper (Vol. XVII, pp. 57-68) had recourse to additional points when dealing with the kraits as a group.

move a few inches of its body behind the head. It must have been enduring the most fearful torture but even in this predicament though alert and lively, moving its head and quivering its tongue, it refused to bite things thrust at, or held up to it. In trying to remove it from the rusty prongs that pierced its body, it endured the suffering for some time, but finally buried its teeth into a mass of fat that had escaped from its wounds. When freed it did not repeat the act, or betray any further vice. I noticed that two specimens I had caged together used periodically to grasp one another's bodies in their jaws, one shifting its grasp down the length of the other, as though seeking a favourable spot to commence devouring its mate.

Many specimens I played with or teased, simply hid the head beneath coils, and refused to move. Some I noticed flattened the hinder part of the body and inflated and deflated themselves anteriorly like many other snakes under excitement, and it is remarkable how expansive the lung must be, for in one specimen, in which marked inflation was noticeable from the 3rd to the 18th twin white arches, it was found upon subsequent dissection that the lung only reached as far back as the 7th twin arches. It very frequently emits the tongue in a leisurely fashion when provoked. Its placid disposition banishes all fear, and tempts one to disregard any precautions in handling it, at least this is my experience.

I noticed especially in Delhi years ago that Kallan the most intrepid snakecatcher I have ever seen, who collected scores of poisonous snakes every week, treated the krait with supreme indifference, though he exercised the greatest caution in dealing with *Echides*.

Fayrer* says: "In my experience I had always the greatest difficulty to get the cobra, krait, and daboia to bite voluntarily." Nicholson† calls it a "very inoffensive" snake. Gleadow‡ says "I have always found it quiet, and not pugnacious." Millard‡ remarks that it is "very shy." Colonel Dawson ‡ says, "It is a very shy snake, and rarely bites except in self-defence or when hurt." This is fully exemplified by the behaviour of the snake which

* Loc. cit., p. 64.

† Ind., Snakes, p. 147.

‡ In Epistola.

caused the fatality, in the case of the keeper reported herein. The krait was unearthed while the man was digging. He picked it up, and tied a piece of cloth round its head, which the snake got rid of several times on the road from his house to Trivandrum Gardens. Arrived at the gardens the snake again freed its head, and it was whilst trying to bind it on again that the bite was inflicted. Dr. J. R. Henderson writes to me: "I have frequently kept this species living but could make little of it, except that it appeared sluggish, and not easily irritated."

The behaviour of a specimen placed by Russell with a cobra bears out the above opinions. He says, "The next subject opposed to the cobra, was a Gedi Paragoodoo" (common krait) "which, in all its movements, was much tamer than either of the former two" (*i.e.*, *Zamenis fasciolatus* and *Vipera russellii*), "and seemed solely intent on escaping out of the room, or retreating into a dark corner. When pushed roughly on the cobra, and consequently struck by him, he made no resistance, nor snapped in return; he did not even offer to retreat, but laid himself close to the cobra, whose body he often touched in his convolutions, without any apparent offence being taken." Colonel Dawson tells me that at Trevandrum when given a pot of sand or earth he has seen them trying to bury themselves.

Food.—This species, like others of this genus, is in the main ophiophagous in habit, but in a state of nature as well as in captivity will partake of most other things offered. I have on eight occasions found snakes eaten, once *Bungarus walli* and once *Lycodon aulicus* and on the other occasions *Typhlops braminus*. In every case where young examples had fed *Typhlops* had been taken. Mr. Millard tells me that "those kept in the Society's Rooms refused all food but snakes." Dr. J. R. Henderson tells me, "I have frequently given a captured specimen a living snake to eat, and in most cases the latter was inside the krait by next morning. On one occasion one disposed of a *Dryophis* longer than itself." Father Dreckmann writes to me, "their food, as far as I can judge, consists exclusively of other snakes. I have never found anything else in their stomachs, and a very fine specimen disgorged three other snakes in different stages of digestion during the first night of its captivity." There are at least 7 other records reported in this Journal where other snakes had been devoured.

On the other hand I have twice known frogs eaten, and Fayrer * records a similar experience. In the Administration Report of the Madras Museum, 1896 to 1897, one specimen is reported to have eaten 2 frogs, and another 18 frogs during incarceration. I have twice found toads (*Bufo andersoni*) in the stomach, and once a monitor lizard (*Varanus flavescens*). Small mammals too are occasionally devoured. I once found a muskrat (*Crocidura cæruleus*) in gastro, and Assistant Surgeon Robertson told me he found 5 young muskrats taken on one occasion. I have twice seen a brood of young mice which had been swallowed, and in Bannerman's escaped specimen, when ultimately recovered, the meal consisted of 6 newly born rats. Captain Liston, I.M.S., tells me that at Parel they have lately found that both kraits and Russell's vipers readily eat the young fœtus from rats in an advanced state of pregnancy.

Sloughing.—The krait casts its skin probably every month. One in captivity in the Madras Museum, captured on the 7th November 1896, sloughed on the 7th December 1896, the 13th January, and 27th February 1897.†

Haunts.—Fayrer says, "It is found in the fields, grassy plains, rice khets, low scrubby jungle, and among debris of wood and buildings. It sometimes insinuates itself into houses, in the verandah, bathrooms, on the ledges of doors or jhilmils, into book cases, cupboards, etc." Millard writes to me, "It is very fond of living in the roofs of bungalows." Theobold‡ speaking of kraits as a group says, "They delight in water and its vicinity," an observation which receives support among others from Father Castels, S.J., who writes to me that in Trichinopoly "small specimens have been brought to me in bundles of 20 or more caught, as they said, in water." I have had several specimens brought to me that were captured in water. These were, I think, always captured in the hot weather, which seems to show that they grow very thirsty and for this reason they frequently get into places from which they cannot extricate themselves, such as wells, and the little pukka tanks connected with the irrigation arrangements so commonly seen in Indian Gardens.

* Loc. cit., p. 121.

† Administration Report, 1896 to 1897.

‡ Journl. Asiatic Soc. Bengal, 1868, p. IV.

They appear to me to be commonest in the precincts of man, and to actually domicile themselves in human habitations for choice. Thus the krait may usually be reckoned as one of the commonest snakes to be found about cantonments and even in the bazaars, and its numerical strength is probably little dreamt of by even the most nervous residents. In Fyzabad for instance I obtained 47 specimens in June, July, and August 1906, all caught or killed in cantonments. Judging from the weekly bags brought in by the snake-catcher Kallan at Delhi it was probably as common in that station. A very large number of my specimens were encountered inside bungalows, outhouses, bazaars and about jails. As a rule they have been found on the ground, or floors, far less commonly in the roofs, or situations necessitating clambering efforts. It appears to be decidedly nocturnal in habit, most of my specimens have been killed at night. Mr. Millard mentions in a letter to me that in captivity it likes to get away from the light, and Colonel Dawson informs me that "in captivity they never move as a rule during the day time but become very active about dusk."

Poison.—Authentic records of krait bite are rare although the species is so abundant in man's immediate environment. This is partly due no doubt to the inoffensive nature of the snake already remarked upon, but must also be largely attributed to the incompetency of many medical men to recognise it. There can be no doubt, from what is known of the virulence of krait venom, that a fatal issue usually attends the bite of this snake.

Fayrer* quotes the remarkable homicidal case originally reported by Chevers where four credulous men allowed themselves to be bitten by a krait about three feet long under the assurance that no evil effects would follow. They were bitten one after another at night, the sampwallahs goading the snake to fulfil their purpose by administering blows with a cane. The first man bitten died before dawn, having complained of thirst and foamed at the mouth. The second and third died about noon the next day, and the fourth recovered after suffering from giddiness, perspiration, pain in the stomach and unconsciousness. Fayrer† reports another case where a chowkidar died six hours after having been bitten in the forefinger. He suffered burning pain locally, later in the head, and then in the

* Loc. cit., p. 51.

† p. 54.

whole body. He grew weak till he could hardly articulate and a drowsiness supervened which culminated in death. A third case recorded by Fayrer died three hours after a bite in the finger. Here again great pain was experienced locally, and swelling. His respiration became short and hurried, he complained of constriction round the chest, became increasingly drowsy till death. Elliot records the death of a sepoy thirty-one hours after being bitten on the ankle. No symptoms were recorded. He was treated with ligature, and incision, and $1\frac{1}{2}$ grains of strychnia were administered hypodermically.

Another case was recorded in the *Indian Medical Gazette* of February 1874. The subject, a Hindu male, aged about 60, was bitten in the left index finger, at 9 p.m. one evening. At 5 a.m. the next morning he was admitted into hospital with giddiness, drowsiness, incoherent speech, difficult breathing and a choking sensation in the throat. He could not walk or sit up unsupported. The hand was livid, swollen, and painful. An hour later his parotid glands were noticed swollen, he vomited, and had severe shooting pain in the left thigh. Later vomiting was repeated, breathing became more oppressed, and he became very restless. At 7 a.m. he was unable to speak or swallow, his eyelids had drooped, and he was constantly putting his hand into the mouth as though to attempt to remove some obstacle. His leg muscles twitched. The symptoms increased, and he died at 9 a.m. in convulsions. He was treated with six intravenous injections of liquor ammonia, amounting in all to three drachms.

I am indebted to Colonel F. W. Dawson for the following :—A keeper in the Trivandrum Museum was bitten on the right index finger by a small krait, one and-a-half feet long, at about 1-30 p.m., 13th August 1907. The bite felt like a pinprick, there was no bleeding, and indeed no mark whatever of a puncture. He went home having declined all persuasions to go to hospital, and apparently stayed in his house till about 3 p.m., when he began to feel a burning pain in the bitten finger. He walked to a hakim's house without any difficulty, and soon after arriving suffered intense pain in the abdomen. At 5-30 his neck became rigid so that he could not turn his head, and his body became rigid so that he could not stoop. He was unable to talk. His respirations became laborious and coma

set in. Frothy matter, and a quantity of phlegm-like mucous passed with great difficulty from the mouth and nostrils. Towards the climax he had two convulsive seizures, and he died apparently from suffocation at about 7 p.m. the same day. It was observed that the heart pulsated some time after breathing had ceased. Further Colonel Dawson says, "There have been several cases of death from bites of the krait here lately, in all of which the prominent symptoms were burning pain of the bitten part, rigidity of the neck and pain in the abdomen." He was informed by his head-keeper that a neighbour's boy of 6 or 7 years of age had awaked one morning recently with an intense pain in the abdomen. He was treated in hospital for stomach-ache, and sent home. On moving the mat on which the child had slept a krait was discovered. A train of symptoms very similar to those experienced by the keeper who died followed, and the child died. No mark of a puncture could be found on the body.

Lieut-Colonel Dimmock, I.M.S., has kindly communicated the following interesting case: A Hindu male, aged 35, was bitten on the dorsum of the right foot at 11 p.m. on the 29th November 1907 by a small krait "about two feet long" identified as such at the Parel Laboratory. At the Railway Hospital, Bombay, two punctures half an inch apart at the seat of the reported bite were slightly incised, and permanganate of potash applied. He was transferred to the Jamsetjee Jejeebhoy Hospital where the punctures were freely incised, and permanganate crystals rubbed in. On admission he was reported as "suffering from fright, pretended to be insensible but is quite conscious." . . . "In the night his pulse became slow and feeble, and respirations shallow, and hurried. Next morning he was quite well and went home at noon." Internally he was treated with ammonia, and hypodermically with strychnia. The dose of poison injected may have been small, but whatever the dose it certainly appears as if the permanganate had very completely neutralised its action as no symptoms occurred other than those directly referable to fright. Ammonia and strychnia have both been proved powerless agents in snake bite, though, of course, they are powerful restoratives in combating fright.

Poison apparatus. Fangs.—These structures are relatively small when contrasted with those of vipers, and even perhaps with that of the

cobra. In a well grown adult I have measured the fangs one-eighth of an inch along the straight, and I think in the largest specimens they will be found scarcely to exceed this length. They are canaliculate with a very obvious seam on the anterior face where the circumflexed margins of the walls forming the canal meet. Often two fully operative fangs occur side by side in the same jaw. Behind these the maxilla is hollowed to receive the sac in which the reserve fangs develop, and behind this again it gives origin to four small teeth, which are grooved though in no way connected with the poison apparatus.

Glands.—These structures, as far as I can judge, are relatively about as well developed as in the cobra. They are smooth, somewhat retort-shaped, and when cut into reveal a cancellous structure similar to the appearance of a sponge.

Poison. Physical properties.—I have rarely seen the poison “in vitro” either in the liquid or dried state, and can find no special references to its re-action, taste, and appearances, etc. To the naked eye it appears, when fluid, much like cobra venom, a clear fluid, with the consistency and colour of pale salad oil.

Quantity.—I have no records of the yield of a single gland nor can I find any in literature, but the yield is, I think, very considerably less than that of a cobra of the same size.

Poison.	Subject.	Minimal lethal dose per kilogram weight in milligrammes.	Authority.	Reference.
Krait ...	Pigeon ...	·25	Rogers... ..	} Phil. trans. Royal Soc. London, 1904, Series B., Vol. 197, pp. 137 and 147.
Cobra ...	„ ...	·4 to ·5	„	
Krait ...	Rat ...	1·00	Elliot, Sillar and Carmichael.	Loc. cit. p. 327.
Cobra ...	„ ...	·04 to ·07	Lamb	Scient. Mem. Officers Med and Sanitary Department. No. 7, p. 19.
„ ...	White rat..	·25	Fraser	

Toxicity.—As will be seen from the annexed table it is impossible from the present available research work to draw a comparison between the relative virulences of krait and cobra venoms. The investigators quoted are all men of the greatest ability, their work when critically studied is convincingly careful and precise, and yet their results vary enormously. Rogers makes it appear that krait venom is about twice as deadly as cobra venom. Fraser's results compared with Elliot, Sillar and Carmichael's show that cobra venom is four times as potent as krait venom, and Lamb's results compared with the same trio's concedes to cobra venom a toxicity twenty times that of the krait. Lamb,* however, from his own researches with both poisons on rabbits, shows that krait venom is proximately four times as virulent as cobra venom. In considering the question it must be borne in mind that samples of venom from individuals of the same species vary somewhat, thus Lamb fixed the minimal lethal dose of cobra venom for rats with one sample at $\cdot 04$ milligrammes per kilogram weight, and with another sample found it was $\cdot 07$ milligrammes.† Again animals vary in their susceptibility to different venoms, thus Lamb found a rat more susceptible to cobra venom than a rabbit, but a rabbit more susceptible than a rat to *Enhydrina* venom. ‡ It is reasonable to suppose that the quality of the secretion may be affected by health, in fact we know it is, for Lamb has remarked with others on the decrease in quality and quantity of venom in snakes kept in captivity. Doubtless season, and possibly youth, and old age similarly affect the poison secreted. Further there are the conditions affecting the animals experimented upon. Not all individuals of the same species are equally susceptible, and health and age doubtless modify their susceptibility. Again I have shown, I think, good reason to suppose that the snake *Bungarus candidus* as hitherto understood includes 3 or 4 forms which may be distinct species. If all these forms are mixed up, and their poisons which may be very different in toxicity, collected together as krait venom, this alone might account for the conflicting results. In future experiments I think every care should be taken to keep the poisons of the various forms apart.

* "*Snake poison and Snake bite*," p. 8. This reference is the same as that appearing in Clifford Allbutt's *System of Medicine* (Lamb and Martin).

† *Memoirs officers*, Govt. of India No. 5, p. 14.

‡ *Loc. cit.*, p. 7.